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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the illuminating cover instrument fabricated from an acrylic resin board and this resin board excellent in the aesthetic property of light diffusibility, a light transmittance state, lightfastness, and a sheet surface.

[0002]

[Description of the Prior Art]The board molding of the acrylic resin composition which distributed the charge of an optical dispersing agent in the use of which the light diffusibility of an illuminating cover, a lighting signboard, a display, a transmission type screen, etc. is required from the former is used. It is that the light which the light transmittance state penetrated highly as performance required of these board moldings diffuses highly, and is not colored. In order to reply to these demands, many proposals, such as a constituent which added the light diffusion agent of various kinds of inorganic systems to acrylic resin, a constituent which added the light diffusion agent of the organic system, and a constituent which used together the inorganic system light diffusion agent and the organic system light diffusion agent, and was added, have so far been made. Especially with the organic system light diffusion agent, it is shown in these that the constituent which used the cross linked particle of the polystyrene system as a light diffusion agent is excellent in light diffusibility. However, although this thing is excellent in light diffusibility, when lightfastness is inferior, it has a fault of light turning yellow in the use irradiated strongly, for example like light covering, while a Plastic solid uses it. By the amount used which becomes enough [ an inorganic system light diffusion agent ] as light diffusibility, there is a fault to which a light transmittance state falls substantially. Thus, the acrylic resin board to which a light transmittance state and lightfastness are satisfied with light diffusibility is not shown until now.

[0003]

[Problem(s) to be Solved by the Invention]Especially this invention was excellent in the aesthetic property of a light transmittance state, lightfastness, and a sheet surface with the outstanding light diffusibility, an object of this invention is to provide the resin board which consists of an acrylic resin composition suitable for a lighting use.

[0004]

[Means for Solving the Problem]In order to obtain a resin board which was excellent in a light transmittance state and lightfastness with outstanding light diffusibility, as a result of repeating research wholeheartedly, this invention persons a spherical cross linked particle of a polystyrene system which has specific mean particle diameter to methacrylic system resin A specific amount, It finds out having the performance which a resin board obtained from a resin composition which carried out specific amount addition of an organic system spherical cross linked particle which has specific mean particle diameter, and the inorganic system light diffusion agent which has specific mean particle diameter respectively should satisfy, and came to complete this invention.

[0005]Namely, the spherical polystyrene system cross linked particle 0.1 - 0.9 weight section (A) methacrylic system resin 100 weight section and whose (B) mean particle diameter of this invention are less than 1-5 micrometers, At least one-sort 0.1 to 10 weight section and, and (D) mean particle diameter which were chosen from an organic system [ which is 1-20 micrometers ] spherical [ mean particle diameter ] cross linked particle (C) Less than 1 micrometer, Or it is related with an illuminating cover instrument fabricated from an acrylic resin board and this resin board excellent in light diffusibility formed from a resin composition which consists of at least one-sort 0.1 to 10 weight section chosen from an inorganic system light diffusion agent which is not less than 8 micrometers. Hereafter, this invention is described in detail.

[0006]The methacrylic system resin (A) and (E) as used in the field of this invention. For example, a polymer which uses methacrylic acid ester, such as methyl methacrylate or ethyl methacrylate, as the main ingredients is mentioned, To this, acrylic ester and acrylonitrile, such as homopolymers, such as methyl methacrylate or ethyl methacrylate, methyl methacrylate or ethyl methacrylate, [, such as methacrylic acid ester methyl acrylate, ethyl acrylate or butyl acrylate ] Any one or more sorts of the copolymerizable monomers, such as a methacrylonitrile, acrylic acid, methacrylic acid, acrylic acid amide, an methacrylic acid amide, a maleic anhydride, styrene, alpha-methylstyrene, and cyclohexyl methacrylate, of copolymers etc. are mentioned. These copolymers can use together and use one sort or two sorts or more. These copolymers are obtained by a suspension polymerization method and an emulsion polymerization process which are already known, a solution polymerization method, etc. As for this, although 50,000-500,000 are preferred as for the weight average molecular weight, it is desirable to use and adjust chain transfer agents, such as alkyl mercaptan, at the time of a

polymerization. By blending rubber compositions, such as acrylic rubber and butadiene series rubber, with these methacrylic system resin as a shock-resistant modifier, it is especially possible to consider it as a resin composition or a Plastic solid excellent in shock resistance, and it is effective in a Plastic solid with weak intensity with thin meat.

[0007]The mean particle diameter is less than 1-5 micrometers, and spherical polystyrene system cross linked particles (B) used for this invention are \*\*\*\* for 0.1 - 0.9 weight sections to methacrylic system resin (A) 100 weight section. Light diffusibility of less than 0.1 weight sections is insufficient, and if 0.9 weight section is exceeded, lightfastness will worsen, for example, a fault of yellowing occurring in an operating environment with which light is strongly irradiated with an illuminating cover etc. appears, and it is not desirable. Light diffusibility and light diffusibility fall [ the mean particle diameter ] at less than 1 micrometer. As an example of a spherical polystyrene system cross linked particle, a copolymer of a styrene monomer and a polyfunctional vinyl monomer, A copolymer with a styrene monomer, monofunctional vinyl monomers, such as methyl acrylate (meta), and a polyfunctional vinyl monomer, etc. are raised, and these are obtained as a spherical particle by polymerization methods, such as a suspension polymerization method and an emulsion polymerization process.

[0008]Although a problem sets the above-mentioned spherical polystyrene system cross linked particle to lightfastness and quantity which is not is used, since light diffusibility is still insufficient, then, an organic system spherical cross linked particle (C) and an inorganic system light diffusion agent (D) are used in order to compensate this. At this time, at concomitant use with two sorts of a polystyrene system spherical cross linked particle (B) and an organic system spherical cross linked particle (C), it is deficient in a white feeling, becomes what lacks in design nature when an acrylic resin board obtained also lacks in \*\*\*\*\*, for example, is used for an illuminating cover etc., and is not desirable.

[0009]Mean particle diameter of an organic system spherical cross linked particle (C) is 1-20 micrometers, and is \*\*\*\*\* for 0.1 - 10 weight sections to methacrylic system resin (A) 100 weight section. If a light transmittance state falls in less than 1 micrometer and mean particle diameter exceeds 20 micrometers, since light diffusibility will fall, it is not desirable. It is 2-10 micrometers preferably. In less than 0.1 weight sections, if light diffusibility falls, and ten weight sections are exceeded, since a light transmittance state will fall, the amount used is not preferred. It is 0.1 to 5 weight section preferably.

[0010]Although a siloxane system cross linked particle, an acrylic cross linked particle, etc. are mentioned as an organic system spherical cross linked particle, in these, a silicon system cross linked particle is preferred. An inorganic system light diffusion agent (D) is used for the purpose with which a white feeling is compensated, mean particle diameter is less than 1 micrometer, a white feeling cannot be enough given in 1 micrometers or more, and it is not desirable. Since it is expensive, the organic system spherical cross linking agent (C) can

transpose the part to an inorganic light diffusion agent (D). In that case, not less than 8 micrometers is used for mean particle diameter. In less than 8 micrometers, decline in light transmittance of a resin board is size, and is outside the range of this invention. As an example of an inorganic light diffusion agent (D), calcium carbonate, barium sulfate, titanium oxide, talc, etc. are mentioned, and 1 or two sorts or more are used.

[0011]An acrylic resin board which whose total light transmittance obtained by this invention is not less than 50%, and an optical dispersion ratio shows not less than 80% at, and also has a white feeling, and was excellent in an optical property and design nature is what that is not shown until now and has surprising performance is completely new. Next, since aesthetic property, such as whiteness and grinding, is adjusted in the surface of a resin board of this invention and design nature is improved, a different resin composition in the range in which a light transmittance state and light diffusibility are not reduced greatly can be laminated to one side or both sides.

[0012]As a different resin composition used for lamination, methacrylic system resin (E) 100 weight section is received. at least one sort as which at least one sort and mean particle diameter which were chosen from an organic system [ which is 1-100 micrometers ] spherical [ mean particle diameter ] cross linked particle (G) were chosen from an inorganic system light diffusion agent (F) which is 1-100 micrometers of sum totals being 8 - 50 weight sections, and. (G) A resin composition in which a weight ratio of / (F) was added on 0.2 or more conditions is preferred. As for thickness of a laminating section, at this time, 10-500 micrometers is preferred, and it is not desirable in order to reduce the light transmittance state of a layered product, if it is difficult to adjust aesthetic property, such as whiteness on the surface of a resin board, and grinding, and it exceeds 500 micrometers, when thinner than 10 micrometers. It is 10-200 micrometers preferably. In less than 1 micrometer, a lusterless effect on the surface of a resin board does not have particle diameter of an organic system spherical cross linked particle (G) and an inorganic system light diffusion agent (F) which are used at this time, and if it exceeds 100 micrometers, it cannot give whiteness to the resin board surface. It is 2-50 micrometers preferably. When emphasizing whiteness on the resin board surface, in mean particle diameter, of 20 micrometers or less when frosting the resin board surface for a thing of a large diameter comparatively, mean particle diameter can choose particles of proper mean particle diameter by aesthetic property of the not less than 2-micrometer resin board which uses a thing of a diameter of a granule comparatively and is demanded. If less than eight weight sections are not enough as grant and a lusterless effect of whiteness on the surface of a resin board and 50 weight sections are exceeded to methacrylic system resin (E) 100 weight section, since a light transmittance state will fall, the amount used is not preferred. It is eight to 30 weight section preferably. Weight ratio [ of an organic system spherical cross linked particle (G) and an inorganic system light diffusion agent (F) ] (G)/(F) is used or more by 0.2. When an

addition of an inorganic system light diffusion agent increases, lusterless texture of a resin board becomes rude and aesthetic property is missing. It is 0.5 or more preferably. As an example of an organic system spherical cross linked particle (G) used, a polystyrene system cross linked particle, A siloxane system cross linked particle, an acrylic cross linked particle, etc. are mentioned, and calcium carbonate, barium sulfate, titanium oxide, talc, etc. are mentioned as an inorganic system light diffusion agent, and from these, one sort or two sorts or more are used together, and it is used. it can be alike by adding a spray for preventing static electricity in an acrylic resin board, and antistatic property can be given. As a kind of spray for preventing static electricity, electrolyte auxiliary agents, such as elastomers, such as polyether ester amide, polyalkylene glycol, polyether ester, and polyether imide amide, and sodium dodecylbenzenesulfonate, can be arbitrarily added according to a military requirement. These sprays for preventing static electricity can be manufactured by low cost by not adding to the acrylic whole resin board, but adding only on a surface of a resin board.

[0013]Next, to a resin composition which forms a resin board of this invention, an antioxidant, light stabilizer, or an ultraviolet ray absorbent can be added according to the purpose. As an example. As \*\*\*\*\*, they are stearyl beta-(3, 5-G t-butyl 4 hydroxyphenyl) propionate, 1 and 3, 5 trimethyl 2 and 4, 6-tris(3, 5-G t-butyl 4-hydroxybenzyl) benzene, and tetrakis with a phenolic antioxidant. [Methylene 3-(3', 5' - G t-butyl 4'-hydroxyphenyl) propionate] Methane, 2, and 2' methylenebis. (4-ethyl 6-t-butylphenol) etc.. In a phosphite system antioxidant, tris(stearylphosphite), tris (2, 4-G t-buthylphenyl) phosphite, cyclic-neopentane-tetraolbis (2, 6-di-t-butyl methylphenyl) phosphite, A SAIRIKKU neopentyl tetrayl screw (octadecyl phosphite) etc. are mentioned for bis(2, 2, 6, 6, - tetramethyl 4-piperidyl)sebacate etc. by hinder TOAMIN system light stabilizer, As an example of an ultraviolet ray absorbent. In a \*\* benzophenone series ultraviolet ray absorbent, 2, 4-dihydroxybenzophenone, 2-hydroxy 4-octoxybenzophenone, bis(2-methoxy 4-hydroxy 5-benzoylphenyl)methane, etc. with a benzotriazol system ultraviolet ray absorbent 2-. (2'-hydroxy 3',5'-JI and t-buthylphenyl) Benzotriazol, 2-(2'-hydroxy 5'-methylphenyl) benzotriazol, 2,2-methylene bis [4-(1,1,3,3, - tetramethylbutyl)-6-(2H-benzotriazol 2-yl) phenol] \*\* is mentioned for \*\* phenyl salicylate, p-t-buthylphenyl salicylate, p-octyl phenyl salicylate, etc. with a salicylic acid system ultraviolet ray absorbent. These are used in the range of 0.005 to 1 weight section to methacrylic system resin 100 weight section.

[0014]Although an acrylic resin board of this invention fits light covering from aesthetic property of the light diffusibility, a light transmittance state, lightfastness, and a sheet surface being especially good although it is possible to use it by a various application, it is not limited. a manufacturing method of a resin board of this invention -- especially -- \*\*\*\*\* -- fabricating by a publicly known forming process is possible. For example, although all are possible, a sheet by an extrusion machine which has a polishing roll or an extrusion molding method of a film, an

injection molding method by an injection molding machine which has an allocated type metallic mold, a press molding method by a press-forming machine which has an allocated type metallic mold, a vacuum molding method by a vacuum forming machine which has an allocated type metallic mold, etc., In this, a sheet extrusion molding method by an extrusion machine which has a polishing roll is preferred for obtaining large-sized mold goods by low cost. When obtaining a laminate sheet, a usual laminating method, the co-extrusion-molding method, etc. can be used, but in these, an extrusion molding method which used a sheet dice of feed block form and a sheet dice of multi-manifold form is advantageous in respect of a manufacturing cost. As for resin temperature, when carrying out with an extrusion molding method, it is preferred to carry out in 180-280 \*\*.

[0015]Next, a resin board of this invention is processible with general forming processes, such as pressure forming, vacuum forming free hot forming, etc. which are used for shaping of the usual acrylic resin plate.

[0016]

[Embodiment of the Invention]Although an example and a comparative example are used for below and the gestalt of this invention is explained to it still more concretely, this invention is not restricted at all by this. The evaluation and the test method which were used are shown below.

1. Total light transmittance It measured based on JIS K-7105.

2. Optical dispersion ratio Measuring equipment: Goniophotometer (made by OBUTESU)

Measuring condition: Diameter of an entering light parallel pencil from a light source to a sample 30-mm diameter of light sensor in diameter A calculating method of the 10 mm light dispersion ratio in diameter: Measurement angle At 5 times, 20 degrees, and 70 degrees Diffused light quantity was measured and the optical dispersion ratio was computed with the following formula.

[0017]

Diffused light quantity is respectively set to alpha, beta, and gamma at order.

Optical dispersion ratio (%)  $= (\beta + \gamma / \alpha \times 2) \times 100$ . lightfastness The sample was irradiated with the high-pressure mercury-vapor lamp for two weeks on the conditions of 75 \*\* of ambient temperature. The color difference (\*\*E) of the sample catoptric light the back and before and behind an exposure was measured.

Color-difference measuring method: It measured based on JIS K-7105.

4. Aesthetic property of sheet surface grinding The lusterless state of the sheet surface was observed visually and the quality of aesthetic property was evaluated from the state of lusterless delicacy or surface roughness.

[0018]

It is beautiful grinding and aesthetic property is good. - It is in O surface skin roughness state,

and aesthetic property is bad. - Tone of x5. board The color tone of the sample under a fluorescent lamp is observed visually, and it is for an illuminating cover use. The white feeling demanded was evaluated.

There is a white feeling and it is good. - There is no O white feeling and it is poor. - x[0019]  
 [Example 1] Asahi Chemical Industry acrylic resin "DERUPETTO LP gas-1" 100 weight section, Sekisui Plastics polystyrene bridge construction bead "theque polymer SBX-4:mean particle diameter (B) of 4.5 micrometers" 0.8 weight section, Toshiba silicon company make siloxane system cross linked particle "toss pearl 2000B : Mean-particle-diameter [ of 6 micrometers ] (C)" 1.5 weight sections, It was considered as the inorganic system light diffusion agent, "calcium carbonate:mean particle diameter of 0.7 micrometer" 1.5 weight section was mixed with the drum blender, a 30-mm twin screw extruder was used, and it kneaded and corned with the resin temperature of about 250 \*\*, and was considered as the resin composition. Thickness created the 30-cm-wide acrylic resin board at 2 mm using the sheet forming equipment which consists the obtained resin composition of the extrusion machine and the polishing roll of three which have 65mmphi and a sheet dice of ratio-of-length-to-diameter=32. At this time, temperature of an extrusion machine and a die was performed at 250-260 \*\*. The obtained piece of a resin board blank test was started, and total light transmittance, an optical dispersion ratio, lightfastness, and tone were evaluated. A result is shown in Table 1. The total light transmittance of a resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness and tone.

[0020]

[Example 2] In Example 1, it carried out like Example 1 except having changed the cross linked particle of (C) into "the toss pearl 120:mean particle diameter of 2 micrometers." A result is shown in Table 1. The total light transmittance of the obtained resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness and tone.

[0021]

[Example 3] In Example 1, it carried out like Example 1 except having changed the cross linked particle of (C) into "the toss pearl 3120:mean particle diameter of 12 micrometers." A result is shown in Table 1. The total light transmittance of the obtained resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness and tone.

[0022]

[Example 4] In Example 1, the addition of 0.3 weight sections and a siloxane system cross linked particle "toss pearl 2000B:mean particle diameter (C) of 6 micrometers" was changed into 2.0 weight sections, and also the addition of the polystyrene bridge construction bead "theque polymer SBX-4:mean particle diameter (B) of 4.5 micrometers" was carried out like Example 1. A result is shown in Table 1. The total light transmittance of the obtained resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness

and tone.

[0023]

[Example 5] In Example 1, the addition of 0.3 weight sections and an inorganic system light diffusion agent "calcium carbonate:mean particle diameter of 0.7 micrometer" was changed into 2.0 weight sections, and also the addition of the polystyrene bridge construction bead "theque polymer SBX-4:mean particle diameter (B) of 4.5 micrometers" was carried out like Example 1. A result is shown in Table 1. The total light transmittance of the obtained resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness and tone.

[0024]

[Comparative example 1] In Example 1, the polystyrene bridge construction bead "theque polymer SBX-4:mean particle diameter of 4.5 micrometers" was independently added 3.8 weight sections as a light diffusion agent, and also it carried out like Example 1. A result is shown in Table 1. The obtained resin board is bad [ lightfastness ] impractical, although total light transmittance and an optical dispersion ratio show a high value.

[0025]

[Comparative example 2] In Example 1, 3.8 weight sections of siloxane system cross linked particles "toss pearl 2000B:4:mean particle diameter of 6 micrometers" were independently added as a light diffusion agent, and also it carried out like Example 1. A result is shown in Table 1. Total light transmittance, an optical dispersion ratio, and lightfastness show scarce appearance to the white feeling of a good thing, and the obtained resin board is impractical.

[0026]

[Comparative example 3] In Example 1, 3.8 weight sections of "calcium carbonate:mean particle diameter of 0.7 micrometer" of the inorganic system light diffusion agent was independently added as a light diffusion agent, and also it carried out like Example 1. A result is shown in Table 1. The obtained resin board is small [ total light transmittance and an optical dispersion ratio ] impractical.

[0027]

[Comparative example 4] In Example 1, calcium carbonate of the inorganic system light diffusion agent was changed into the thing with a mean particle diameter of 5 micrometers, and also it carried out like Example 1. A result is shown in Table 1. Total light transmittance and an optical dispersion ratio show scarce appearance to the white feeling of what shows a high value, and the obtained resin board is impractical.

[0028]

[Comparative example 5] In Example 1, \*\*\*\* for "calcium carbonate:mean particle diameter of 0.7 micrometer" 1.9 weight sections carried out the siloxane system cross linked particle "toss pearl 2000B:mean particle diameter (C) of 6 micrometers" like Example 1 as an inorganic



system light diffusion agent with 1.9 weight sections as a light diffusion agent. A result is shown in Table 1. The obtained resin board shows total light transmittance, an optical dispersion ratio, and appearance deficient in a white feeling small [ both ] and, and is impractical.

[0029]

[Example 6] In Example 1, the toss pearl 2000B was decreased to 1.0 weight sections, 1.0 weight sections were added and also talc whose mean particle diameter is 10 micrometers as an inorganic system light diffusion agent was carried out like Example 1. A result is shown in Table 1. Total light transmittance and an optical dispersion ratio showed the high value, and the obtained resin board excelled [ dispersion ratio ] also in lightfastness and tone.

[0030]

[Example 7] Use as a central layer the resin composition used in Example 1, and to the both sides Asahi Chemical Industry acrylic resin "DERUPETTO LP gas-1" 100 weight section, The resin board which laminated the layer of the resin composition which consists of talc 10 weight section and Toshiba silicon company make siloxane system cross linked particle "toss pearl 120:mean particle diameter of 2 micrometers" 10 weight section which are the particle diameter of 15 micrometers as an inorganic system light diffusion agent was manufactured. Both sides of the laminated thickness of a resin layer are 30 micrometers, and the thickness of the whole resin board was adjusted to 2 mm. The manufacturing method of the resin board at this time was carried out to the extrusion of the resin composition for lamination at the extrusion of the central layer using the extrusion machine of 90mmphi and ratio-of-length-to-diameter=32, using the extrusion machine of 30mmphi and ratio-of-length-to-diameter=24. The die adjusted the thickness of the resin board in the clearance of the lip opening and the polishing roll using the two-sort feed block type of three layers. Temperature of an extruder and a die was performed at 250-260 \*\*. The obtained piece of a resin board blank test was started, and it was similarly estimated as Example 1. A result is shown in Table 1. The total light transmittance of a resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness and tone.

[0031]

[Example 8] The resin composition used for lamination in Example 6 Asahi Chemical Industry acrylic resin "DERUPETTO LP gas-1" 100 weight section, It changed into the resin composition which consists of talc 5 weight section and Toshiba silicon company make siloxane system cross linked particle "toss pearl 120:mean particle diameter of 2 micrometers" 15 weight section which are the particle diameter of 15 micrometers as an inorganic system light diffusion agent, and also carried out like Example 6. A result is shown in Table 1. The total light transmittance of the obtained resin board and an optical dispersion ratio are high values, and were excellent also in lightfastness and tone.

[0032]

[Comparison 6] The lamination thickness of the resin composition used for lamination in Example 6 was 5 micrometers, and also it carried out like Example 6. By lamination thickness being thin, the appearance of a resin board is in the state of surface roughness, and is impractical.

[0033]

[Comparative example 7] The resin composition used for lamination in Example 6 Asahi Chemical Industry acrylic resin "DERUPETTO LP gas-1" 100 weight section, It changed into the resin composition which consists of talc 30 weight section and Toshiba silicon company make siloxane system cross linked particle "toss pearl 120:mean particle diameter of 2 micrometers" 30 weight section which are the particle diameter of 15 micrometers as an inorganic system light diffusion agent, and also carried out like Example 6. A result is shown in Table 1. By the organic system particles in the resin composition used for \*\*\*\*\* and the concentration of an inorganic system light diffusion agent being large, the appearance of the obtained resin board is in the state of surface roughness, and is impractical.

[0034]

[Table 1]

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[0035]

[Effect of the Invention] Since the acrylic resin board of this invention is excellent also in the aesthetic property of a light transmittance state, lightfastness, and a sheet surface with the light diffusibility which was extremely excellent as compared with the conventional light diffusibility resin board, in lighting uses, such as an illuminating cover, it is very useful especially.

[Translation done.]